

IN THE CLAIMS:

1. (currently amended) A method for fabricating thin film oxides, the method comprising:
 - forming a substrate;
 - treating the substrate at temperatures equal to and less than 360° C, using a high density (HD) inductively coupled plasma (ICP) source; and,
 - forming an M oxide layer overlying the substrate where M is an element selected from a group including elements chemically defined as a solid and having an oxidation state in a range of +2 to +5.
2. canceled
3. (currently amended) The method of claim [[2]] 1 wherein forming a substrate includes forming a substrate including M; and,
 - wherein using an ICP source includes plasma oxidizing the substrate.
4. (original) The method of claim 3 wherein plasma oxidizing the substrate includes inductively coupling plasma:
 - at a temperature of 360° C;
 - in a range of 13.56 to 300 megahertz (MHz) with a power density up to 10 watts per square centimeter (W/cm²);
 - at a pressure of up to 500 milliTorr (mTorr);
 - with a mixture of inert gas and oxygen in a ratio of approximately 10:1 to 200:1; and,

with a total gas flow of approximately 50 to 200 standard cubic centimeters per minute (sccm).

5. (original) The method of claim 4 wherein inductively coupling plasma includes varying a substrate bias in a range of 50 kilohertz (KHz) to 13.56 MHz with a power density up to 3 W/cm².

6. (currently amended) The method of claim 4 wherein inductively coupling plasma with a mixture of inert gas and oxygen includes mixing oxygen with inert gas selected from the group consisting of ~~including~~ helium, argon, and krypton.

7. (original) The method of claim 4 wherein forming a substrate including M includes forming a silicon layer.

8. (original) The method of claim 7 further comprising:

forming a transparent substrate layer; and,

forming a diffusion barrier overlying the transparent substrate layer and underlying the silicon layer;

wherein forming a silicon layer includes forming transistor channel, source, and drain regions in the silicon layer;

wherein forming an M oxide layer includes forming a gate dielectric layer of the oxide; and,

the method further comprising:

forming a gate electrode overlying the gate dielectric layer.

9. (original) The method of claim 8 wherein forming a gate dielectric layer of the oxide includes forming a dielectric layer with:
a fixed oxide charge density of less than 5×10^{11} per square centimeter (/cm²);
an interface trap concentration of approximately $.9 \times 10^{10}$ to 8×10^{10} per square centimeter – electron volt (/cm² eV);
a flat band voltage shift of less than 1 V;
a leakage current density lower than 10^{-7} amperes per square centimeter (A/cm²) at an applied electric field of 8 megavolts per centimeter (MV/cm); and,
a breakdown field strength greater than 10 MV/cm.

10[[,]]. (currently amended) The method of claim 7 wherein forming an M oxide layer includes forming a silicon oxide layer with a refractive index between approximately 1.45 and 1.47.

11. (original) The method of claim 3 wherein forming a substrate including M includes:
forming a base layer of a material; and,
depositing a thin film of element M overlying the base layer;
and,
wherein plasma oxidizing the substrate includes plasma oxidizing the thin film of M.

12. (currently amended) The method of claim [[2]] 1 wherein using an ICP source includes using an HD plasma enhanced

chemical vapor deposition (HD-PECVD) process to treat the substrate;
and,

wherein forming an M oxide layer overlying the substrate
includes depositing the M oxide layer.

13. (original) The method of claim 12 wherein using an
HD-PECVD process to treat the substrate includes inductively coupling
plasma:

in a range of 13.56 to 300 MHz with a power density up to 10
W/cm²;

at a pressure of up to 500 mTorr; and,

with a mixture of reactive gases and precursor compounds
having M in a decomposable form, the gases and precursor compounds in
a ratio selected in accordance with the valence state of M.

14. (original) The method of claim 13 wherein
inductively coupling plasma includes varying a substrate bias in a range
of 50 KHz to 13.56 MHz with a power density up to 3 W/cm².

15. (original) The method of claim 13 wherein forming
a substrate includes forming a silicon layer.

16. (original) The method of claim 15 wherein
inductively coupling plasma with a mixture of reactive gases and
precursor compounds having M in a decomposable form, the gases and
precursor compounds in a ratio selected in accordance with the valence

state of M includes inductively coupling plasma with a mixture of SiH₄, N₂O, and N₂ gases in a ratio of approximately 10:100:50 to 25:100:50.

17. (original) The method of claim 16 further comprising:

forming a transparent substrate layer; and,

forming a diffusion barrier overlying the transparent substrate layer and underlying the silicon layer;

wherein forming a silicon layer includes forming transistor channel, source, and drain regions in the silicon layer;

wherein depositing the M oxide layer includes depositing a gate dielectric layer; and,

the method further comprising:

forming a gate electrode overlying the gate dielectric layer.

18. (original) The method of claim 17 wherein forming a gate dielectric layer includes forming a dielectric layer with:

a fixed oxide charge density of less than $5 \times 10^{11}/\text{cm}^2$;

an interface trap concentration of approximately 2×10^{10} to $8 \times 10^{10}/\text{cm}^2$ eV;

a flat band voltage shift of less than 1 V;

a leakage current density lower than 10^{-7} A/cm² at an applied electric field of 8 MV/cm; and,

a breakdown field strength greater than 10 MV/cm.

19[[]]. (currently amended) The method of claim 15 wherein depositing the M oxide layer includes depositing a silicon oxide layer with a refractive index between approximately 1.45 and 1.47.

20. (currently amended) The method of claim 1 wherein forming a substrate includes forming a substrate where M is silicon selected from the group consisting of ~~including~~ amorphous silicon, microcrystalline silicon, and polycrystalline silicon.

21. (currently amended) The method of claim 1 wherein forming, overlying the substrate, an M oxide layer includes forming an M oxide selected from the group consisting of ~~including~~ M binary oxides and M multi-component oxides.

22. (currently amended) The method of claim 1 wherein treating the substrate at temperatures equal to and less than 360° C using an ICP ~~HD-plasma~~ source includes using a plasma source selected from the group consisting of ~~including~~ electron cyclotron resonance (ECR) plasma sources and cathode-coupled plasma sources.

23. (original) A method for fabricating thin film oxides, the method comprising:
forming a substrate;
treating the substrate at temperatures equal to and less than 360° C, using a transmission/transformer coupled plasma source; and,

forming, overlying the substrate, an M oxide layer where M is selected from a group including elements chemically defined as a solid and having an oxidation state in a range of +2 to +5.

24. (currently amended) An in-situ method for fabricating thin film oxides, the method comprising:

- in a film processing chamber, forming a substrate;
- leaving the substrate in the film processing chamber,
- treating the substrate at temperatures equal to and less than 360° C,
- using a high density (HD) inductively coupled plasma (ICP) source; and,
- in the film processing chamber, forming, overlying the substrate, an M oxide layer where M is selected from a group including elements chemically defined as a solid and having an oxidation state in a range of +2 to +5.